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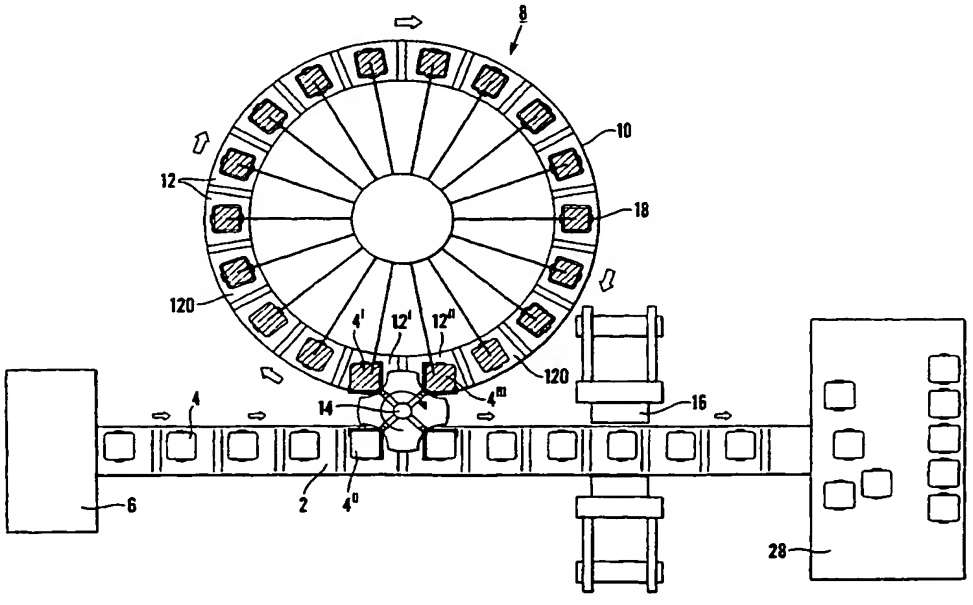
(54) Title: CONDITIONING APPARATUS FOR A MOULDING MACHINE



(57) Abstract: Conditioning apparatus for a moulding machine comprises input means (2) for transporting injection moulded preforms (4) sequentially towards a conditioning station (8), and output means (2) for transferring conditioned preforms sequentially from the conditioning station (8) for further processing, the conditioning station (8) comprising a plurality of sub-stations (12) therein through which each preform (4) is sequentially indexed from an input position to an output position, and heating means (18) which, during movement of the preforms (4) from the input position to the output position, conditions the preforms (4).

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CONDITIONING APPARATUS FOR A MOULDING MACHINE

TECHNICAL FIELD

This invention relates to moulding machines, and more particularly to conditioning apparatus for incorporation in such machines to reheat injected moulded preforms prior to stretching and blowing the reheated preforms into containers.

BACKGROUND ART

It is well-established practice in the moulding of containers first of all to provide a so-called preform by injection moulding techniques, then to condition the preform by re-heating in preparation for the stretch and blow stage, and finally to eject the completed container after stretching and blowing into the desired shape.

In the case of round containers, the conditioning of the preforms is conventionally effected in static heat tunnels, the preforms being transported through the tunnels on conveyors whilst being rotated, thereby to condition the preform as is necessary for subsequent stretching and blowing.

The symmetrical nature of the preforms for round containers, and the rotation thereof as they pass sequentially through the heat tunnel, ensures accurate heat distribution to all critical regions of the preforms in preparation for the stretching and blowing operation, and whereby it is possible to produce round blow moulded containers at an extremely high rate.

The production of rectangular section containers poses more of a problem, in particular because different regions of the preform require different degrees of re-heating prior to the stretching and blowing stage. Thus, it is not possible to condition the preforms for rectangular containers in a conventional heat tunnel as is the case with preforms for round containers.

Current practice with rectangular section containers is therefore to utilise a single machine to effect the various stages associated with the production of the container. The injection moulded preform is produced at a first station, the machine is rotated through 90° to transport the preform to a second station where it is conditioned, the machine is rotated through another 90° to locate the re-heated preform in a stretch and blow station, and a final rotation of 90° transports the container to an eject station.

Such a machine is very expensive to provide, and only enables production of containers at a relatively slow rate, typically one every 10 seconds or so.

SUMMARY OF THE INVENTION

It would be desirable to be able to provide conditioning apparatus for a moulding machine whereby the machine is capable of producing rectangular section containers at a higher rate and more cost efficiently than heretofore.

According to the present invention there is

provided, for a moulding machine, conditioning apparatus characterised by input means for transporting injection moulded preforms sequentially towards a conditioning station, and output means for transferring conditioned preforms sequentially from the conditioning station for further processing, the conditioning station comprising a plurality of sub-stations therein through which each preform is sequentially indexed from an input position to an output position, and heating means which, during movement of the preforms from the input position to the output position, conditions the preforms.

It will be appreciated that such apparatus enables a number of preforms, in particular rectangular preforms, to be conditioned sequentially as each preform moves through each sub-station from the input position to the output position, the heating means being such as to provide controlled heat distribution across all critical areas of the preforms in anticipation of the subsequent stretch and blow procedure.

The provision of such apparatus thus significantly increases the throughput of the associated moulding machine compared with the known arrangements, it being anticipated that it will be possible to produce about 3000 rectangular containers per hour using the apparatus of the invention.

In one embodiment of the invention, the conditioning station comprises a rotatable support member having a plurality of circumferentially spaced

sub-stations therearound each adapted to receive therein an associated preform, each sub-station, during rotation of the support member, being indexed from the input position to the output position.

Preferably the apparatus includes a plurality of heaters, one for each sub-station, the heaters being rotatable with the support member and adapted to heat the associated preform over a substantial proportion of its travel time between the input position and the output position.

Conveniently each heater comprises an upper element and a lower element having operative positions substantially encasing the associated preform.

Preferably the conditioning station includes cam means therein with which the upper and lower elements of the heaters co-operate such that the elements are moved to their operative positions encasing the associated preforms subsequent to rotation of the preforms from the input position and said elements are displaced from their operative positions to disengage from the preforms prior to rotation of the preforms to the output position.

In an alternative embodiment of the invention, the conditioning station comprises a conveyor carrying a sequence of longitudinally spaced preforms each of which is linearly indexed through a plurality of sub-stations between the input position and the output position, heating means being provided above and below the

conveyor.

Preferably such apparatus includes a plurality of heaters adapted to heat each preform throughout its linear passage from the input position to the output position.

Conveniently each heater comprises an upper element and a lower element having operative positions substantially encasing the associated preform.

In a preferred arrangement, the upper elements of the heaters are mounted on an upper conveyor above the preforms, and the lower elements of the heaters are mounted on a lower conveyor below the preforms, the upper and lower elements being arranged to move into operative positions encasing the associated preform on arrival of the elements at the input position of the conditioning station, and being arranged to be displaced from their operative positions to disengage from the preforms on arrival of the elements at the output position of the conditioning station.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows part of a first moulding machine incorporating conditioning apparatus of the invention, together with a detail thereof referenced Fig. 1a, and

Fig. 2 shows part of a second moulding machine incorporating conditioning apparatus of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, the illustrated machine includes a belt conveyor 2 for transporting a series of

injection moulded rectangular preforms 4 from an unscrambler 6 towards a conditioning station indicated generally at 8. The station 8 comprises a rotatable support member 10 provided with a series of circumferentially spaced sub-stations 12 each adapted to receive therein an associated preform 4.

Transfer means, in the form of a four-armed star wheel 14, react between the conveyor 2 and the support member 10 to load the preforms 4 from the conveyor sequentially into the sub-stations 12. More particularly, the linear speed of the conveyor 2, the speed of rotation of the star wheel 14 and the speed of rotation of the support member 10 are synchronised and indexed whereby, on initial loading of the support member 10, a first preform 4' on the conveyor 2 is gripped by a first arm of the star wheel 14, the star wheel is rotated and the preform 4' is deposited in a sub-station 12' of the support member located at that time in the input position of the station 8.

At the same time as the first arm of the star wheel 14 is depositing the preform 4' in the input sub-station 12', the second arm of the star wheel 14 grips the next incoming preform 4" on the conveyor 2. The rotation of the star wheel 14 then brings this next preform 4" to the input position by which time the next sub-station 12" has arrived at the input position of the station 8, and the next preform 4" is deposited in the next substation 12".

This procedure continues using all four arms of the star wheel 14 sequentially until all of the sub-stations 12 are filled, and the support member 10 has rotated through 360° to bring the initial sub-station 12' to the output position of the station 8.

During rotation of the support member 10, the preforms 4 carried thereby are conditioned as will be detailed below.

When a preform 4''' reaches the output position of the station 8, and at the same time as one arm of the star wheel 14 is gripping a preform 4" on the conveyor 2 and another arm of the star wheel 14 is depositing a preform 4' in the sub-station at the input position of the station 8, a third arm of the star wheel 14 grips the conditioned preform 4''' in the sub-station 12" at the output position, subsequent rotation of the star wheel 14 transferring that preform 4''' back onto the conveyor 2 by which it is transported towards a blow and stretch station 16.

Thus it will be appreciated that, once the sub-stations 12 on the support member 10 are all loaded with preforms 4, and at any given time during operation of the machine, the four arms of the star wheel 14 each carry a preform 4 as shown in the drawing each at a different stage of processing. The rotation of the star wheel 14 and the support member 10 is synchronised and indexed to ensure continuity in the progress of each preform 4 from the conveyor 2 and back onto the conveyor

2.

The conditioning of the preforms 4 in their passage from the conveyor 2 and back onto the conveyor 2 will now be described in more detail.

The conditioning station 8 further includes a plurality of circumferentially spaced heaters 18, one for each sub-station 12, the heaters 18 being rotatable with the support member 10. Each heater 18 comprises an upper heating element 20 shaped to conform with the hollow interior of, and to be received within, the preform 4, and a lower heating element 22 shaped to conform with, and to receive therein, the preform 4 whereby the combination of upper and lower elements 20,22 can embrace and contain an associated preform as shown to the left in Fig 1a.

The upper and lower heating elements 20, 22, during their rotation with the support member 10, are movable between an operative position encasing a preform 4 and a displaced position remote from the preform 4 as shown to the right of the detail drawing.

More particularly, the conditioning station includes, above and below the heaters 18, a pair of fixed cam tracks 24,26 (see Fig. 1a) with which the upper and lower heater elements 20,22 respectively co-operate during their rotation from the input position of the station 8 to the output position thereof, the tracks 24,26 being configured so that the heater elements 20,22 are opened as a conditioned preform 4''' approaches the

output position to enable discharge of the conditioned preform 4''' from its sub-station 12'' by the star wheel 14, the heaters remaining open as they pass the input position to enable loading of a preform 4' into the sub-station 12', and thereafter being closed to embrace the loaded preform. In the drawing, the heaters are shown as opening at the sub-station referenced 12_o and remaining open until they are closed again at the sub-station referenced 12_c.

During rotation of a preform between the sub-station 12_c and 12_o, the heaters 18 distribute heat internally and externally to the preforms 4 across and through all critical areas thereof in a controlled manner to ensure optimum conditioning thereof through the complete cycle of the conditioning station 8.

Thus, on arrival at the blow and stretch station 16, the preforms 4 are in optimum condition for formation into the desired containers, the blow and stretch operation being carried out either from the top down or, after transfer of the preforms to an upside down position, from the bottom up.

After formation, the containers are indexed out on the conveyor 2 to a packing station 28.

Thus it will be appreciated that the provision of the rotating station 8 enables a regular sequence of conditioned preforms 4 to be presented to the stretch and blow station 16 and whereby the rate of production of rectangular section containers is considerably

increased compared with current arrangements in which each individual preform is conditioned separately. It is anticipated that a production rate of the order of one per second will be achieved.

Referring to Fig. 2 of the drawings, there is shown an alternative arrangement in which the preforms are indexed linearly through the conditioning station rather than rotatably.

More particularly, preforms 30 are transported linearly on a conveyor 32 from an unscrambler (not shown) towards a blow and stretch station 34, and are indexed sequentially through a series of sub-stations 36 along the conveyor 32 from an input sub-station 36' to an output sub-station 36''.

The conditioning station includes heating means for conditioning the preforms 30 during their passage between the input and output sub-stations 36',36'', each heater comprising an upper heating element 38 and a lower heating element 40. The upper elements 38 are mounted on an upper conveyor track 42, and the lower elements are mounted on a lower conveyor track 44, the positions of the elements 38,40 on the tracks 42,44, and the rotation of the tracks 42,44 being arranged and indexed to bring consecutive elements 38,40 into positions above and below the input sub-station 36' as consecutive preforms 30 are indexed to arrive at said input sub-station.

Cam means (not shown) move the elements 38,40 into

engagement with, to embrace, each preform 30 as it arrives at the input sub-station 36', and disengage the elements 38,40 from each preform 30 as it arrives at the output sub-station 36'', although the drawing shows the heaters disengaged from the preforms throughout their passage.

During movement of the preforms 30 between the stations 36', 36'', the heaters distribute heat internally and externally to the preforms 30 as in the embodiment of Fig. 1 whereby the preforms are in optimum condition for subsequent processing.

Clearly the precise construction of the conditioning apparatus can be varied from that illustrated without departing from the scope of the invention. The means by which the preforms are loaded into the conditioning station, as well as the precise configuration and action of the heaters, may be altered, while the path between the input and output sub-stations may be linear, rotary or other configuration. The invention is particularly suited to containers of polyethylene terephthalate (PET), and enables the production of strong, clear, glass-like containers in that material at a rate which has heretofore not been possible.

Although described in relation to rectangular containers, the invention is equally applicable to the production of containers of other shapes, including round.

CLAIMS

1. Conditioning apparatus for a moulding machine, the apparatus being characterised by input means (4) for transporting injection moulded preforms (4) sequentially towards a conditioning station (8), and output means (2) for transferring conditioned preforms sequentially from the conditioning station (8) for further processing, the conditioning station (8) comprising a plurality of sub-stations (12) therein through which each preform (4) is sequentially indexed from an input position to an output position, and heating means (18) which, during movement of the preforms (4) from the input position to the output position, conditions the preforms (4).

2. Apparatus as claimed in claim 1 in which the conditioning station (8) comprises a rotatable support member (10) having a plurality of circumferentially spaced sub-stations (12) therearound each adapted to receive therein an associated preform (4), each sub-station (12), during rotation of the support member (10), being indexed from the input position to the output position.

3. Apparatus as claimed in claim 1 or claim 2 and including a plurality of heaters (18), one for each sub-station (12), the heaters (18) being rotatable with the support member (10) and adapted to heat the associated preform (4) over a substantial proportion of its travel

time between the input position and the output position.

4. Apparatus as claimed in claim 3 in which each heater (18) comprises an upper element (20) and a lower element (22) having operative positions substantially encasing the associated preform (4).

5. Apparatus as claimed in claim 4 in which the conditioning station includes cam means (24,26) therein with which the upper and lower elements (20,22) of the heaters (18) co-operate such that the elements (20,22) are moved to their operative positions encasing the associated preforms (4) subsequent to rotation of the preforms (4) from the input position, and said elements (20,22) are displaced from their operative positions to disengage from the preforms (4) prior to rotation of the preforms (4) to the output position.

6. Apparatus as claimed in claim 1 in which the conditioning station comprises a conveyor (32) carrying a sequence of longitudinally spaced preforms (30) each of which is linearly indexed through a plurality of sub-stations (36) between the input position and the output position, heating means (38,40) being provided above and below the conveyor (32).

7. Apparatus as claimed in claim 6 and including a plurality of heaters (38,40) adapted to heat each preform (32) throughout its linear passage from the input position to the output position.

8. Apparatus as claimed in claim 7 in which each heater comprises an upper element (38) and a lower

element (40) having operative positions substantially encasing the associated preform (32).

9. Apparatus as claimed in claim 8 in which the upper elements (38) of the heaters are mounted on an upper conveyor (42) above the preforms (30), and the lower elements (40) of the heaters are mounted on a lower conveyor (44) below the preforms (30), the upper and lower elements (38,40) being arranged to move into operative positions encasing the associated preform (30) on arrival of the elements (38,40) at the input position of the conditioning station, and being arranged to be displaced from their operative positions to disengage from the preforms (30) on arrival of the elements (38,40) at the output position of the conditioning station.

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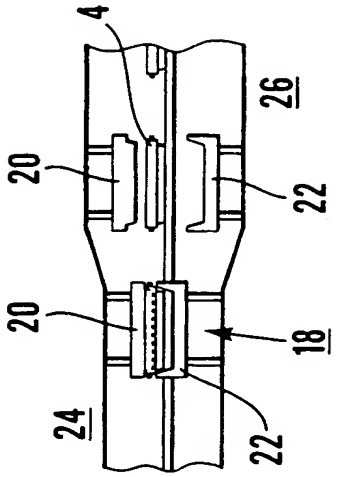

Fig.1a

Fig.1

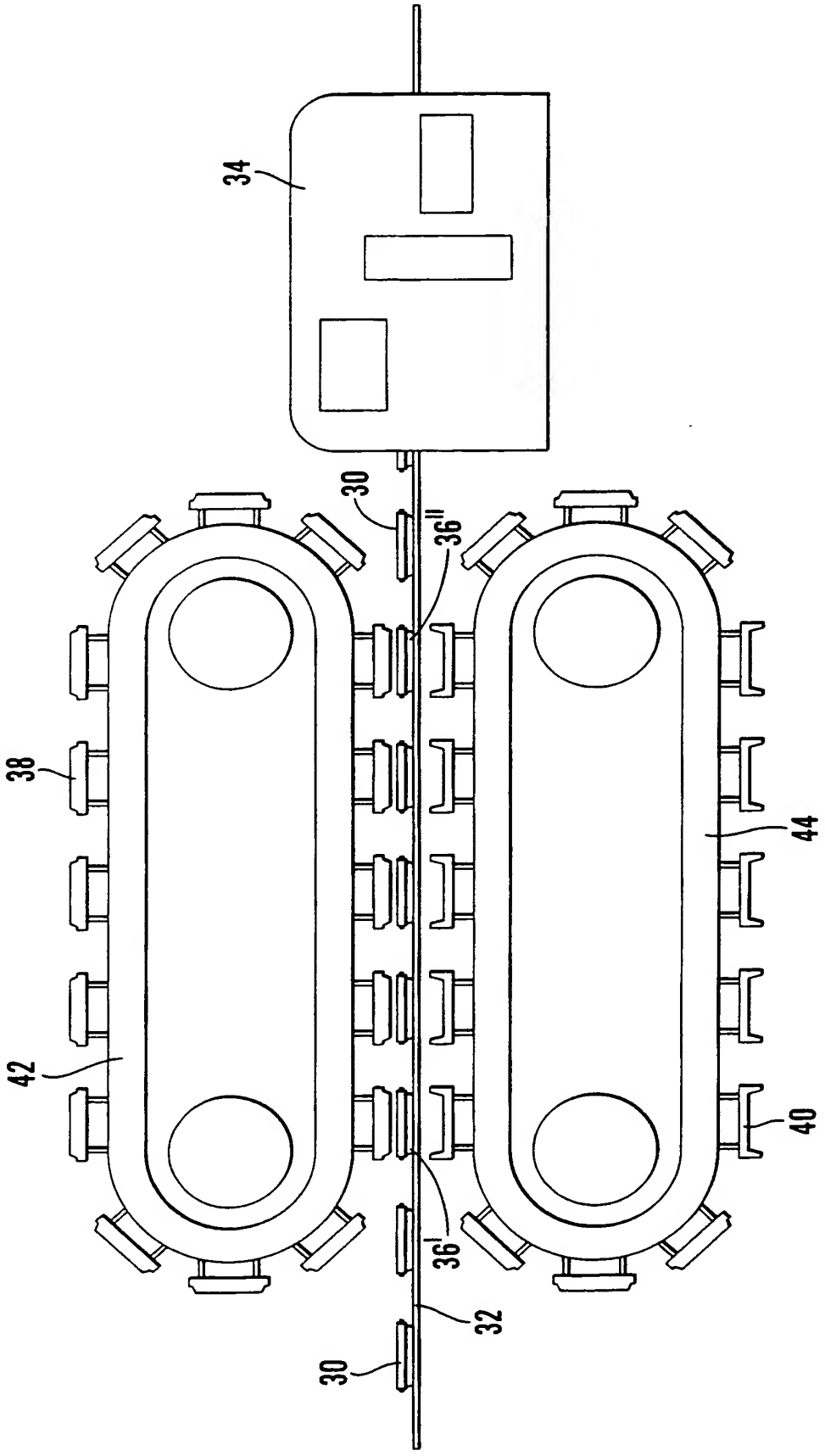

Fig.2

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29C49/64 B29C51/42 B29C49/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
10 July 2001	18/07/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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